

THE EARLY STAGES OF *SCIADOCERA RUFOMACULATA* WHITE
(DIPT. PHORIDAE).

By MARY E. FULLER, B.Sc.

(With a foreword by A. L. Tonnoir.)

(Eight Text-figures.)

[Read 28th March, 1934.]

Foreword (by A. L. Tonnoir).

In a previous paper (Tonnoir, 1926) I called attention to and discussed a fly, *Sciadocera rufomaculata* White,* which had been considered till then as belonging to the Empidae. I concluded that its affinities were with the Phoridae and that a new subfamily should be erected to receive it.

Father Schmitz, writing an account (1929) of a similar fly from Southern Chile, did not agree with my views and erected a new family to receive this genus; further, he concluded that the strongest affinities of *Sciadocera* were with the Platypezidae and not with the Phoridae.

Schmitz remarked that I had disregarded any possible connection between *Sciadocera* and the Platypezidae. This is not quite correct, because three years before (Tonnoir, 1923) I had placed *Sciadocera* in the Platypezidae; but later, after a closer study of the fly, I decided that its affinities were with the Phoridae and discussed them in detail. I did not give the reasons why this insect should not be placed with the Platypezidae, as I considered that the arguments in favour of its being placed with the Phoridae were quite sufficient.

As to the third view, to erect a new family, adopted by Schmitz and also suggested to me by Bezzi, I did not consider this possibility very long, because the Aschiza, being a transition group, is bound to contain a number of aberrant forms, for which it is more useful from the general taxonomic point of view to stress the affinities than to emphasize the differences. *Ironomyia* White would also be given family rank if one were to follow Father Schmitz' principle, instead of being placed with the Platypezidae, as I have done. There are probably a number of other unknown or still insufficiently known forms of the Aschiza for which new families could be erected. The final result would be that there would be a number of monogeneric families which would certainly not have the same status as the other families of the Diptera.

Schmitz concludes: "If we should nevertheless place this genus in this family (Phoridae), then we must have sounder reasons than those which Tonnoir indicates." These sounder reasons (or rather a few more of them) I find now in the recently gained knowledge of the early stages of *Sciadocera*, which it has been the good fortune of Miss Fuller to secure. These indubitably point to the conclusion that *Sciadocera* is a Phorid and that in these stages it is rather far removed from the Platypezidae.

I have previously mentioned having observed the female flies on the carcass of a Wombat, on which they were apparently trying to oviposit. I was therefore

* Through some unfortunate *lapsus calami* the species was mentioned throughout that paper as *S. maculata*.

not very surprised to find some specimens of *Sciadocera* among some insects captured by Miss Fuller in a trap baited with decaying liver. I pointed out to her then what a good opportunity this would be to secure the early stages of this much discussed fly, and she lost no time in obtaining them and describing them very adequately in the following paper.

In his classification of the larvae of the Diptera, Brauer (1883) placed both Phoridae and Platypezidae in the tribe Hypocera of the Aschiza, although he pointed out that there was not a single character in common between the larvae and pupae of the two families. Now that our knowledge of these stages is decidedly more extensive, there is yet no common character of importance to be found, as will be seen from the table I give here.

Platypezidae.

LARVA.

General shape oval, usually strongly flattened dorso-ventrally.

Segmentation: Only ten or nine segments visible from above, the cephalic and the first thoracic segments being bent under the body (Text-fig. 2).

Cephalic segment not conspicuously bilobed.

Metathoracic and first abdominal tergites sometimes fused together.

Breathing system: Posterior spiracles placed on the anterior margin of the eighth abdominal segment and scarcely projecting above the dorsum.

Mouth parts: of a very specialized type.* Oral hooks considerably modified in shape of large rasps and having lost all connection with the rest of the buccopharyngeal armature; they are embedded in the integument of the cephalic segment and move as a whole with that segment. Hypopharyngeal armature with single branches which are fused distally and project a long way out of the mouth but are bent backwards and provided with teeth. Floor of pharynx smooth. A small third median cornu present.

PUPARIUM.

The shape remains the same as in the larva.

Phoridae.

General shape similar to that of the Cyclorrhapha dipteron and usually elongate and subcylindrical.

Twelve segments visible from above.

Cephalic segment projecting forward and strongly bilobed (Text-fig. 1).

Posterior spiracles placed right at caudal extremity of the body and usually borne by a more or less elongated process.

Generalized mouth parts. Two oral hooks articulated on the upper branch of the hypopharyngeal sclerite, whose lower branches are there fused together.

The upper branches of this sclerite sometimes disconnected from the lower ones.

Floor of the pharynx striated or corrugated.

Only two cornua present.

The shape is different from that of the larva; flattened, often tortoise-shaped, the distal end conspicuously curved upwards.

* There is some disagreement about the structure of the mouth parts of the Platypezidae. Bergenstamm (1870) and later Brauer and Bergenstamm (1883) say that there are two well developed oral hooks, whereas de Meijere (1911) and Lundbeck (1927) are of the contrary opinion. From my own observations on a larva of *Platypeza* and judging from the position of the mouth opening, I cannot but conclude that the oral hooks are present in a very modified form as the lateral organs which Bergenstamm calls "radula" but do not homologize. I cannot believe that these organs are entirely new structures. The projecting median-toothed organ which de Meijere and Lundbeck seem to have identified as oral hooks cannot be anything else but a part of the hypopharyngeal armature since it is situated below the oral opening.

Platypezidae.

Spiracles: Anterior spiracles placed on the first thoracic segment and but slightly protruding on the anterior margin of the body.

Dehiscence taking place along a semi-circular line around the margin of the anterior part of the body and also sometimes between the first and second abdominal tergites, so that a piece composed of the meso- and metanotum plus the first abdominal tergite becomes detached.

A study of this table, after reading Miss Fuller's description of the early stages of *Sciadocera rufomaculata*, will convince anyone that this insect does belong to the Phoridae, as not a single one of its larval* or pupal characters can be considered as intermediate between those of the two families here analysed, but they all fall entirely on the side of the Phoridae.

Phoridae.

Anterior spiracles of the transpercing type and placed on the second abdominal segment, usually very elongated.

Dehiscence taking place along a longitudinal median line on tergites of body segments 4 to 6 (abdominal 1 to 3), with further splits between segments 3 and 4 as well as 6 and 7, no piece getting detached.

Introduction.

During the winter of 1932 some curious flies were captured in a glass blowfly trap baited with liver. These were determined as *Sciadocera rufomaculata* White by Mr. Tonnoir, who pointed out the desirability of obtaining a knowledge of the early stages. The captured flies were all females, and several were placed in jars with fresh meat, wool or fungus. They did not oviposit on any of these materials. On the 18th July a female was put into a jar with a piece of old decayed liver in which *Calliphora stygia* larvae had been feeding. This was moist and putrid and was placed on soil. On 1st August small maggots, which on examination were found to be in their second instar, were present on the liver. They grew slowly and eventually pupated. In October a number of *Sciadocera* of both sexes emerged. Previously only females had been taken in this district. The flies which emerged were put into a cage provided with food, water and oviposition media. After a week, a small cluster of eggs, numbering about ten, was deposited on the soil near a piece of liver. These eggs did not hatch and eventually collapsed.

For comparison with *S. rufomaculata* a figure is given of the larval head of *Platypeza griseola* Tonn. which was bred from rotting mushrooms collected in April, 1932.

Length of Stages.

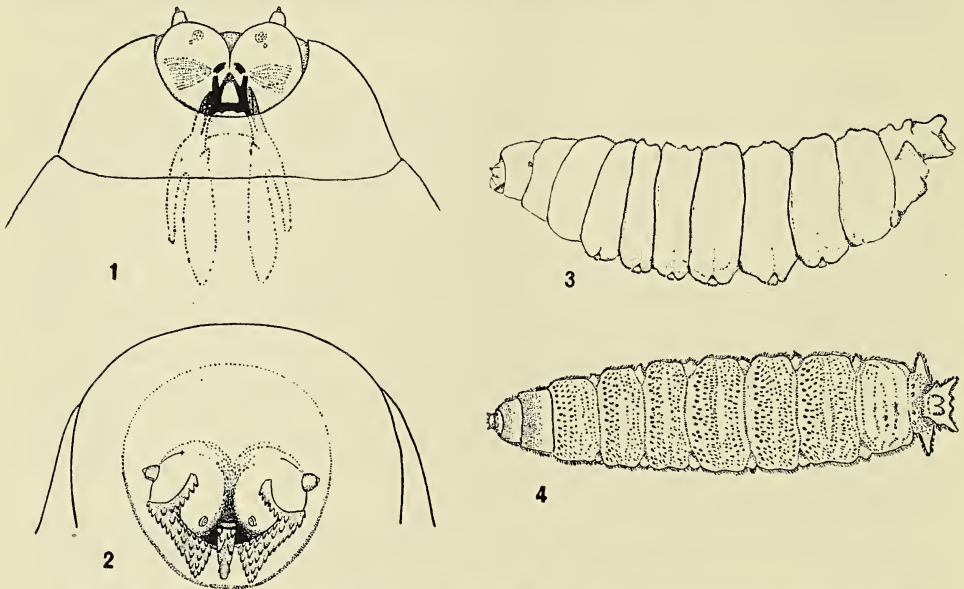
At the temperature in the laboratory (mean temperature for the period approximately 10°C.) the stages were as follows: The feeding period occupied 18 days, the prepupal stage 45 days and the pupal stage 14 days. Half-way through the prepupal period some of the prepupae were transferred to the hot room, which is kept at a temperature of approximately 23°C. The prepupal stage was then shortened to 25 days, but the pupal period was lengthened to 20 days. The longest that any of the flies lived in captivity was three weeks.

Description of Early Stages.

(a) *The Egg*.—The egg is creamy-white in colour. It is 0.64 mm. in length, of an elongate-oval shape, slightly more curved on one side than the other and rounded at both ends. The chorion is heavily sculptured with a pattern of raised, branched, irregularly broken lines.

* With exception of the projecting hypopharyngeal armature.

(b) *Second Stage Larva* (Text-fig. 3).—No first instar maggots are available for description, as the larvae were not discovered until they were in the second instar. The maggots were then 2 mm. long and of a deep cream colour. The second stage larva is short and thick-set, narrowing at either end. Tiny colourless spines are present on the dorsal and ventral surfaces of each segment, particularly near the anterior border. These surfaces are undulating and folded, there being a spiny swelling in the centre of each segment ventrally. There are a pair of spiracles on the first thoracic segment, and a pair on the eighth abdominal segment situated at the ends of a pair of protuberances on the dorsal surface. The eighth segment has a number of other papillae which are described, along with the details of the mouth parts and spiracles, in the full grown maggot. The most noticeable differences in the two stages are the lack of close covering of scales and hairs in the second instar, and the thick cylindrical body, the full-grown maggot being flat and elongated and clothed with hairs.



Text-fig. 1.—Head of third stage larva of *S. rufomaculata*, ventral view. $\times 77$.

Text-fig. 2.—Head of full-grown larva of *P. griseola*, ventral view. $\times 77$.

Text-fig. 3.—Second stage larva of *S. rufomaculata*, lateral view. $\times 30$.

Text-fig. 4.—Third stage larva of *S. rufomaculata*, dorsal view. $\times 8$ approx.

(c) *Third Stage Larva* (Text-fig. 4).—The length of the full-grown maggot is from 7 to 8 mm. The skin is creamy coloured, thickly covered with brown hairs and spines, making the maggot a dirty, light brown colour. The form is typical of Cycloraphous Diptera, the body being formed of a small head, three thoracic, eight normal and two reduced abdominal segments. The larva is pointed at the head end and truncated posteriorly. It is comparatively broad and rather flattened dorso-ventrally, although the dorsal and ventral surfaces are actually slightly convex. The small pointed head is bilobed, with the oral hooks projecting ventrally between the lobes. Each lobe bears a pair of papillae representing maxillary palp and antenna. The antenna is anterior and is comparatively large, with a long narrow apical segment.

The first thoracic segment overarches the head dorsally. Its anterior third consists of a band of many rows of small spines directed backwards, which give place to long hairs in the last few rows. The hairs are more numerous on the sides. The rest of the segment is smooth. The anterior spiracles emerge about the middle of the segment laterally. Each anterior spiracle bears at the end a small plate which is surrounded by a thickened margin, and which has two slits close together. These slits are almost round in outline and resemble those in the posterior spiracles in structure. The second and third thoracic segments have bands of spines anteriorly, but the whole segment is haired, the hairs being most dense on the sides and fading away posteriorly. On the under surface the hairs diverge at the centre and sweep outwards to both sides, the third segment being more hairy underneath than the second.

The first to seventh abdominal segments are similar. Laterally the intersegmental membrane forms a small fleshy protuberance between each segment. Dorsally, on each side of the intersegmental line, the surface is smooth and slightly depressed. There is also on the dorsal surface a narrow shallow depression in the centre of each segment running parallel to the segmentation. The ornamentation on the dorsal surface of each segment is as follows: Near the anterior edge are a number of scattered scale-like spines, which are most numerous on the first abdominal segment. These give place to fine chitinous hairs which project backwards and become more sparse in the centre at the depression. Near the posterior border these hairs are smaller, more numerous and project forwards. They are most dense and conspicuous on the sides, giving the maggot a fringed appearance. The lateral protuberances are also each clothed with a tuft of hairs. All the hairs and spines are brown. The seventh segment is smoother than the others dorsally. It has no scales and the hairs are smaller and fewer.

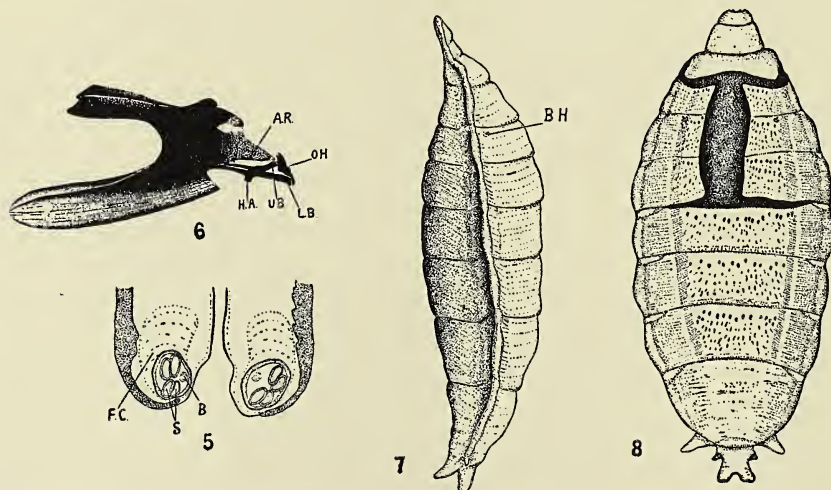
The ventral surfaces of the first seven abdominal segments are similar. They are undulating and covered with an arrangement of scales and hairs. The anterior border is marked in the centre by a number of flat pointed scales directed backwards. The posterior border has similar scales pointing forwards, these being larger and most noticeable on the last few segments. In the centre is a pair of bullae, one each side of the middle, corresponding to the depression on the dorsal surface. These swellings are clothed with very minute spinules and seem smooth by comparison with the rest of the surface. Surrounding them are two or three rows of scales pointed outwards. They become smaller passing outwards, and give place to hairs which cover the rest of the segment. In the centre between the bullae are several larger scales projecting backwards. Each abdominal segment has a lateral fold or ridge which is thickly haired.

The eighth abdominal segment is entirely different from the others. On the dorsal surface near the junction with the seventh are four papillae, two each side of the centre. These end in circlets of small dark spines. Near the anterior end, projecting laterally and slightly upwards and forwards are two large papillae covered with hairs. The dorsal surface of the segment between them is swollen into a ridge covered densely with small spines directed forwards. The segment narrows considerably about the centre and the posterior half of the dorsal surface is bare except along the edge. The segment ends in a pair of large papillae pointing backwards and outwards and covered with hairs. Between them is a pair of smaller papillae, and there is a similar lateral pair anterior to them. From the centre of the dorsal surface of the posterior half of the segment a pair of tubes arise (Text-fig. 5). They project upwards and backwards, and bear the

spiracular plates at their ends. The tubes are highly chitinized on the sides, especially on the outer edge. The plates are small, each with four slits arranged in two pairs.

The anterior half of the under surface of the eighth segment is swollen and densely covered with hairs projecting backwards. There is a depression in the centre, in which are a pair of smooth flaps surrounding the anus and representing the tenth segment. Anterior to this is a larger fold covered with hairs and ornamented on the edge with thick short spines. This probably represents the ninth segment.

Buccopharyngeal Armature (Text-fig. 6).—The mouth parts of *Sciadocera* show many of the general features described by Keilen (1911) for the genus *Phora*. The basal or pharyngeal sclerites are of similar form to those of Muscids and Calliphorids, each consisting of a broad vertical plate deeply incised at the posterior margin to form dorsal and ventral cornua. The incision or gap is very wide and the cornua narrow in *Sciadocera*. The dorsal cornu is narrower and shorter than the ventral which is pointed posteriorly. The floor of the pharynx, which is visible towards the ventral edge of the sclerite, is strongly ribbed or corrugated. The plate joining the dorsal edges of the pharyngeal sclerite anteriorly is prolonged upwards and forwards into a blunt projection. The anterior margin of each pharyngeal sclerite is also produced forwards above the hypopharyngeal sclerite, almost reaching the base of the oral hooks, a feature characteristic of *Phora*. The pair of narrow projections called by Miller (1933) the atrial rods, and by Keilen the *batonnets de la pièce basilaire*, occur along the lower edge of the forward projection of the pharyngeal sclerite, resembling the condition in *Phora*.



Text-fig. 5.—Posterior spiracles of the third stage larva of *S. rufomaculata*. $\times 48$. s, slits; b, button; f.c., felt chamber.

Text-fig. 6.—Mouth parts of third stage larva of *S. rufomaculata*. $\times 44$. a.r., atrial rod; h.a., hypostomal arch; l.b., lower fused branches of hypopharyngeal sclerite; o.h., oral hooks; u.b., upper branches of hypopharyngeal sclerite.

Text-fig. 7.—Puparium of *S. rufomaculata*. $\times 11$. Lateral view. b.h., breathing horns.

Text-fig. 8.—Pupal shell of *S. rufomaculata*. $\times 11$. Dorsal view showing method of dehiscence.

The hypopharyngeal sclerite is of the usual H-shape, but the arms are very narrow and elongated and fused posteriorly with the pharyngeal sclerite. The bar of the H is Miller's hypostomal arch and shows in profile as a ventral projection in *Sciadocera*. The arms of the hypopharyngeal sclerite fork just anterior to the hypostomal arch. The lower branches are produced anteriorly as far as the end of the oral hooks, where they unite to form a short point, which is directed downwards and is less strongly chitinized than the rest. The oral hooks are very small and are situated above the anterior end of the hypopharyngeal sclerite. The basal portion of each is roughly triangular in shape, with a notch in the posterior margin and a small aperture near the centre. The hook part is narrow and curved with the point close to the end of the hypopharyngeal sclerite. The hooks articulate with the upper branches of the hypopharyngeal sclerite, which corresponds in position to the auxiliary piece described by Keilen in *Phora*.

(d) *Puparium* (Text-fig. 7).—The average length of the puparium is 6 mm. It is light brown in colour and is sufficiently thin to show the developing fly a few days before emergence, when it appears black. The puparium is shaped like a tortoise, but rather more elongated, being thin at the edges and convex in the middle. It is attached by the ventral surface, which is also convex, to some object such as a leaf or fragment of wood.

There are eleven segments. The first represents the prothoracic segment of the larva and shows two little projections which were the anterior spiracles. The last segment bears the papillae which characterized the eighth larval segment, the spiracular tubes being at the posterior extremity of the puparium. The small spines and hairs which clothed the skin of the maggot persist, but are darkened and hardened. The puparium is scalloped along the thin flattened edges and is narrowed and flattened on the anterior three segments. The fifth segment bears on the dorsal surface a pair of very minute breathing horns. Each is like a small black spine arising from a darkened spot. When emergence takes place the puparium splits in a line down the centre of the fourth, fifth and sixth segments and also opens between the third and fourth and sixth and seventh segments (Text-fig. 8). A few days before emergence of the fly dark lines appear where the dehiscence takes place.

This method of emergence is similar to that described for other Phorids.

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